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Pyomyositis Tropicans:
A Study of Tropical Muscular Abscesses
in Honduras, Central America

Rodrigo Martinez
B.A., Yale University

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INTRODUCTION

One day during the summer of 1966, while at morning rounds in a hospital in San Pedro Sula, Honduras, I saw a male child who had several abscesses in various muscles. These abscesses were treated by incision and drainage. After several days of improvement of the child's clinical condition, high fevers recurred and, again, abscesses were discovered and drained. The local physicians informed me that this child had a suppurative myositis, a condition which responded to semi-synthetic penicillins. A Gram stain of a smear from one of the abscesses showed Gram positive cocci in clumps. After a few days of therapy, the child's fever disappeared, no new abscesses appeared, and he was discharged.

Upon returning to New Haven to begin the first clinical year, I tried to find out more about this disease, but was unable to obtain any information from various members of the faculty whom I approached. A survey of the literature disclosed a relatively small amount of information concerning muscular abscesses in the tropics, called Pyomyositis Tropicans, Tropical Myositis, or Suppurative Myositis. Further consideration of the problem led to the present study to investigate the cases of Pyomyositis seen in the past in hospitals

in and around San Pedro Sula, Honduras, as well as a study of the etiological factors and treatment of cases to be seen during the course of the following summer. Dr. Lawrence R. Freedman of the Department of Internal Medicine at Yale agreed to supervise the project, and Drs. Cesar Larach and Luis Bueso, chairmen of the Departments of Medicine and Pediatrics, respectively, of the Leonardo Martinez V. Hospital in San Pedro Sula agreed to assist in the study during the months of July and August, 1967.

THE PROBLEM

Though muscular tissue is considered to be a poor focus for the localization of any infectious agent (Adams and Denny-Brown), reports have appeared which indicate that pyogenic infections of muscle do occur. Characteristically, a young person, usually a male who previously has been in good health, presents with the acute onset of spiking fever and with a hot, indurated region in an extremity. After a few days, the region of induration becomes fluctuant, and, when drained, yields pus containing *Staphylococcus aureus*. Occasionally *Staphylococcus albus* and other micro-organisms such as *Streptococcus*, *Proteus*, *E.coli*, and *Pasteurella* may

be the only bacteria recovered. In most cases there is only one abscess; in others these may be multiple. Sometimes the second and subsequent abscesses manifest themselves only after the first one has been drained. In some cases the region of woody induration does not become fluctuant and the illness resolves with no treatment. Drainage and antibiotic treatment, if available, are followed by complete cure in almost 100% of cases. Abscesses elsewhere in the body have not been described. Cough has been mentioned by two authors as a characteristic of the disease (Sayers, James).

These infections have been described in the tropics, in such places as Africa, the Caribbean, Brazil, Malaya, and the Pacific islands, mainly by British and German authors, with occasional reports being written by French and United States physicians. The patients are almost always natives of the area, although there have been case reports of Europeans' manifesting the disease while living in the tropics (Buxton, Robin, and Ashken and Cotton). One report from East Africa (Cook) gives the incidence of the disease as 6.87 per 100,000 population and notes that over the period 1948 to 1963 the number of yearly admissions to the Mulago Hospital (Kampala) for these infections has fallen from 250 to about 50.

It is not clear whether there has been a true decrease in the incidence of the disease or if better methods of treatment (antibiotics) have decreased the need for hospitalization.

The pathogenesis of Pyomyositis Tropicans is unknown, although various theories have been suggested. Toward the beginning of the century, some investigators (Wise and Minnett) suggested that microfilarial infection might lead to lymphatic obstruction in the muscle, leading to stasis and subsequent bacterial localization and abscess formation. While subsequent investigators (Buxton, James, Grace and Grace, Robin, Walker, Burkitt) established that pyogenic bacteria were found in the lesions, they failed to confirm the hypothesis that the patients with Pyomyositis Tropicans had a greater incidence of filarial infection than the population not affected by the disease. They further stressed the fact that the disease had not been reported from such areas of the world as Arabia, India and Australia, where *Wuchereria bancrofti* were found. Sickle cell disease has been suspected as an underlying factor, although in one case where the test was performed it was negative (Leedham-Green and Evans) and in another report only 20% of the patients had a positive test versus 10% of the

controls (Burkitt). Syphilis and other treponemal infections (refuted by Ashken and Cotton), platelet abnormalities, thrombophlebitis (Gelfand), leptospirosis (refuted by Foster), trauma, antecedent skin infection, subclinical scurvy and environmental changes have also been considered to play a role in the pathogenesis of this disease, but the evidence is not convincing.

When incision and drainage have been carried out but no pus obtained, a biopsy of the affected muscle has revealed the presence of coagulative degenerative changes with a monocytic infiltrate resembling Zenker's hyaline degeneration (Leedham-Green and Evans), a non-specific finding in febrile toxic states (Robbins).

Bacterial infection and abscess formation in muscle, while rare, has been reported from temperate regions. Payne (1881) reported an acute, fatal myositis of the thigh in a woman who had delivered an infant the day before the onset of her symptoms. Clark (1887) described a fatal case of muscular abscess in a thigh. Abram (1904) described two cases of axillary myositis which were due to Streptococci; Gage (1919) described three cases of post-influenzal myositis of

the rectus abdominis muscle in which the causative organisms were Pneumococci. Holm (1924) described cases in Scandinavia in which, among others, tiny muscles such as those of the larynx were found to contain abscesses. More recently, Barrett and Gresham (1958) have described four fatal cases of streptococcal myositis. Though the authors compare these cases with those of Pyomyositis Tropicans, it is apparent that their cases, consisting of only one young (33 years) man and the rest being elderly patients, represent a different clinical picture with a rapid downhill course that is not characteristic of Pyomyositis. Sworn (1933) reviewed some of the literature concerning psoas abscesses in temperate regions and then described three cases in which the isolated organisms were Staphylococcus, Streptococcus and Bacillus-pfeiffer. He could find no obvious source for the abscesses and concluded that a bacteremia from an unknown source had seeded the psoas muscles. Finally, Baker (1965) and Blum (1964) have discussed localized psoas abscesses due to mycotic aneurysms.

THE SETTING



The Republic of Honduras is located in the Central American isthmus at approximately latitude 15° North longitude 87° West. It is bordered by the Caribbean Sea on the North, the Pacific Ocean on the South, Guatemala and El Salvador on the West, and Nicaragua on the East. Its size is about the size of the state of Pennsylvania. The climate varies from tropical rain forest in the lowlands to a more temperate climate as one ascends into the mountains that constitute the terrain of most of the country. The main produce of

the country consists of bananas, cattle, and cotton grown in the lowlands, and lumber and coffee from the mountains. The population is almost exclusively a mixed Indian-Spanish with a small percentage being entirely Indian and another small percentage being Negro. There are slightly over two million inhabitants. The country is considered one of the poorest of the Central American countries; the per capita income is less than two hundred dollars.

The rural population of Honduras, which constitutes the vast majority of the inhabitants, lives in poverty and ignorance, and, thus, with disease. Intestinal parasitic infestation constitutes the norm for this population; *Ascaris lumbricoides*, *Trichuris trichiura*, and *Necator americanus* being the organisms most commonly found. Infant mortality, most of it due to diarrhea and dehydration, has been placed as high as 60%. Families tend to be large, five or more children. A rural family usually lives in a champa, or two room hut made of palm fronds and mud. The father and sons who have reached the age of seven will usually work in the family plot which grows corn that has been planted by hand. The field has been cleared by the slash and burn technique. The corn will eventually be sold if

it can be transported to the nearest road where a truck can pick it up and transport it to market.

The government's attempts to improve the health of the population have met with the expected problems due to the economic difficulties of the country. It has been unable to adequately fulfill its curative as well as its public health responsibilities. A program of construction of health centers with outpatient facilities was undertaken by the government with the purpose of having these rural health centers serve as places where wide scale inoculations could be carried out, as well as serving as a site for outpatient medical treatment. These health centers are supplied with inexpensive antibiotics, intravenous fluids and vaccines and are staffed by young graduates of the University of Honduras School of Medicine and by graduates of foreign medical schools, all of whom must complete at least one year of Social Service before being able to establish themselves in practice. Practical nurses and Peace Corps volunteers from the United States are also stationed in these posts. All illnesses not properly treated on an outpatient basis are referred to the government hospitals located in the few large cities, often a full day's journey away.

The Leonardo Martinez V. Hospital in San Pedro Sula is the only government hospital serving the Sula Valley with its approximately 400,000 inhabitants. The city of 100,000 and the valley represent the heart of the country's agriculture and industry. Private enterprise, both Honduran and foreign, produce most of the country's main agricultural exports, namely cattle and bananas, as well as almost all of the country's industrial products, namely cement, textiles, and furniture. The salaries of the employees of these concerns are considerably higher than the income of the rural population. Those who are employed, however, in the menial tasks of these concerns and the self-employed rural farmers of the valley are only slightly better off than the rural population in the other parts of the country, and it is this population that the hospital serves. The Tela Railroad Company, a subsidiary of the United Fruit Company, maintains a hospital that serves its employees. This hospital is located in the village of La Lima, ten miles away from San Pedro Sula.

The Leonardo Martinez V. Hospital has an annual budget of \$375,000. It has 311 beds, 22 cribs, and 2 incubators. There are between 200 and 230 outpatient visits per day and between 50 and 70 Emergency Room

visits. The hospital is staffed by 37 part-time physicians and 8 interns. There are 10 graduate nurses and 108 practical nurses and nurses' aides. There are five Catholic sisters who are also nurses. There are departments of Medicine, Pediatrics, Surgery, Obstetrics and Gynecology and Pathology. Laboratory determinations during the summer of 1967 were limited to complete blood counts, urinalyses, stool examinations for ova and parasites, and simple diagnostic x-ray.

The La Lima Hospital, owned and operated by the Tela Railroad Company, has more modern facilities which, however, were not operating at maximum capacity during the summer of 1967. There are 250 beds, 10 full time doctors, and 400 outpatient visits per day. The laboratory is equipped to perform blood chemical analyses and bacteriological studies. There is an x-ray department.

MATERIALS AND METHODS

Cooperation and assistance were requested of the personnel of both hospitals to carry out the study of muscular abscesses. The physicians of San Pedro Sula, including those not affiliated with the hospital, were made aware of the study and agreed to refer all patients with frank muscular abscesses or suspicion of them to the author at the Leonardo Martinez Hospital. The physicians of the La Lima Hospital were likewise acquainted with the nature of the study and agreed to make available to the study any patient admitted to the hospital with a confirmed or suspected muscular abscess. Once the patients were referred for study, whether in San Pedro Sula or in La Lima, a history was obtained and a physical examination was performed. A mimeographed form was prepared for the study (see Appendix A), to record the history. The history inquired particularly into possible factors such as previous similar symptoms, chronic disease, dietary habits, trauma to the affected region, and recent skin infection. The temperature was recorded and the physical findings and hospital course were described. Depending on the presentation and evolution of the illness, several courses were followed:

a) If the patient presented with an area of inflammation which might have represented possible osteomyelitis, x-ray films were taken at the time the patient was first seen and repeated later in the course, unless a muscular abscess was discovered by exploration. If any abnormality of the bone was seen, the patient was excluded from the series.

b) If the patient presented with obvious signs of abscess formation and no bony abnormality on x-ray, incision and drainage were carried out and no antibiotics were given. If fever persisted after drainage, new abscesses were sought. If others were found, they were also drained. If another possible source of the fever was discovered, such as an upper respiratory infection, this was treated with antibiotics. If the symptoms and the fever disappeared, the patient was considered cured.

c) If there were localizing signs to a muscle group but no discernible abscess formation, then Penicillin G was started and the lesion was followed closely. It either resolved with disappearance of the symptoms or proceeded to abscess formation. This abscess was then drained and antibiotics were discontinued and the patient was followed closely. If he

became asymptomatic and remained so, he was considered cured.

d) If there were localizing signs but no discernible abscess formation and if it was important that the patient be returned to useful life as a wage-earner or if the patient remained under the care of another physician as a private patient, treatment with a semi-synthetic penicillin or with erythromycin was initiated. In these cases the symptoms rapidly disappeared.

The assessment as to whether the inflammatory condition involved muscle or not was made largely on the basis of the physical examination and confirmed by incision and drainage. An abscess was considered to possibly be in muscle if a) there was swelling, warmth and fluctuation of the region but no erythema of the overlying skin, b) no evidence of pulsation of the mass, c) no evidence of thrombophlebitis, and d) no evidence of osteomyelitis. Our impression was strengthened if the overlying skin could be pinched between the thumb and middle finger and could be elevated from the mass. We found it difficult to produce this maneuver in cases in which the swelling had been present for a long time and had progressively increased in size. Also, in longstanding cases we found that the skin overlying

the region became erythematous and acquired the characteristics of the peau d'orange. Drainage of the abscesses could not be performed under general anesthesia due to difficulty in obtaining the operating room on short notice; therefore, it was impossible to make a large incision to permit visual inspection of the underlying muscle. On penetration of the abscess, however, one could definitely feel the end of the clamp penetrate what all observers felt to be the sheath of the muscle involved. In two cases, however, pus was noted to flow before the underlying muscle had been reached in one of the two abscesses with which each one of these cases presented (cases 2 and 7). In these two cases, it is not known whether the muscle was the primary site of the abscess or whether the abscess was limited to the subcutaneous fat. Traquair describes an "aberrant" case of Pyomyositis in whom muscular abscesses co-existed with abscesses in fatty tissue.

The bacteriological studies were performed by the laboratory of the La Lima Hospital. Because of the limited facilities available, cultures were only taken from pus from the abscesses. No blood or urine cultures were obtained. The pus was collected using sterile

technique, either by needle aspiration or by the insertion of an applicator into the abscess cavity. The pus was stained by the Gram method and then was placed in nutrient broth and transported to the laboratory on the same day. The broth was incubated overnight. On the following day, Gram stains were made of the broth. If Gram positive cocci were seen, these were plated on blood agar and sensitivities were determined. A coagulase test was performed. Because of the limitation of facilities already alluded to, Gram negative organisms, if seen, could not be thoroughly identified.

A retrospective study of the cases of Pyomyositis seen in the Leonardo Martinez V. Hospital was undertaken. The section of the records (which date from 1960) labeled Infectious Myositis was found to be incomplete because the records of many cases that individual physicians remembered from the wards could not be found and had been presumably mis-classified. Also, since the Emergency Room records are kept according to dates and not by diagnosis, it was impossible to obtain information regarding cases seen and treated in the Emergency Room in the past. It was felt, therefore, that the case histories taken from

the record room did not adequately represent the population with muscular abscesses that had been treated by the hospital. There were sixteen records filed under Infectious Myositis; of these, four had to be discarded because of insufficient information concerning the case. The twelve remaining cases are summarized in Appendix B and will be referred to as the "old" cases of the Leonardo Martinez V. Hospital.

RESULTS

Between June 15 and August 30, fourteen cases of Pyomyositis Tropicans in its various forms were seen (Appendix C). Whenever possible, these patient were hospitalized. All but three of the patients (cases 1, 2, and 12) were treated personally. Six of the fourteen were from San Pedro Sula itself; the two that were seen in the La Lima Hospital were from a banana plantation; the rest were from other rural areas varying from five to fifty miles distance from San Pedro Sula. With the exception of case 11, a construction team foreman, and case 12, the son of an employee of a customs agency, the patients belonged to the lower socioeconomic classes. Thirteen of the patients were mestizos, or mixed Spanish-Indian; one case (case 5) was a mixed Spanish-Indian-Negro.

Because of the lack of precise recording of home addresses in the old records, the attempt at follow-up of these cases was unsuccessful. Of the new patients, none had ever had the disease before. With the exception of Walker (1917) and Buxton (1928), there is no mention anywhere of a patient having the disease more than once.

With what information could be gathered from both

the old cases and the new patients, certain classifications such as age and sex of the patients and number and localization of the lesions, the percentage of abscess formation and studies on the bacteriology may be tabulated with the information given by other authors in order to compare Pyomyositis as it manifests itself in Honduras with the disease as described from other areas.

Sex

The reported distribution of the disease according to sex indicates that more males than females with the disease are seen. Studies which have reported more than five cases show the following figures:

<u>Author</u>	<u>Year</u>	<u>No. Cases</u>	<u>Males</u>	<u>%</u>	<u>Females</u>
Buxton	1928	41	88		12
Sayers	1930	26	85		15
James	1931	10	80		20
Earle	1939	6	83		17
Robin	1961	12	92		8
Foster	1965	53	68		32

From the series from San Pedro Sula:

	<u>No. Cases</u>	<u>Males</u>	<u>%</u>	<u>Females</u>
"old"	12	75		25
"new"	14	65		35

It would appear that tropical myositis is more common in males than in females, and the results of the investigation in Honduras appear to substantiate this view. In reality this is not very easy to prove because, for complex reasons, in hospitals in developing nations one tends to see more male than female patients, as Foster (1965) notes. For example, in the Leonardo Martinez V. Hospital the surgery and medicine wards for men have twice the capacity of the equivalent women's wards, and there are approximately twice as many male pediatric patients as there are female patients. If, however, one accepts the fact that the disease is more common in males than in females, one must then implicate hormonal and/or occupational and environmental factors. To enter into a discussion of these factors is beyond the scope of this paper. It has been mentioned, however, that males are more exposed to skin lesions and trauma, possible predisposing factors, on the basis of greater occupational hazards (Robertson 1930 and Ashken and Cook 1963). This statement is open to question, however, since children show the male preponderance of infection and women in the lower socioeconomic classes perform large amounts of physical labor.

Age

All authors agree that Pyomyositis Tropicans occurs mostly in younger individuals. Traquair (1947) called it a disease of late adolescence and young adults; Sayers (1930) said it was a disease of young and middle adult life. The breakdown of ages, when given, is recorded here, again for over five cases reported:

<u>Author</u>	<u>Year</u>	<u>No.Cases</u>	<u>0-9</u>	<u>10-19</u>	<u>20-29</u>	<u>30-39</u>	<u>40-49</u>	<u>50-59</u>	<u>60-69</u>
Robertson	1930	20	0	25	40	30	5	0	0
James	1931	10	10	0	40	50	0	0	0
Earle	1939	6	0	0	83	17	0	0	0
Robin	1961	12	8.3	25	58.4	8.3	0	0	0
Foster	1965	53	21	26.5	21	15	11.5	3.5	1.5
"old"		12	25	25	33	17	0	0	0
"new"		14	72	14	14	0	0	0	0

A certain amount of consistency is noted in that our results show that the patients were in the younger age groups. The patients seen during the course of the summer represented a considerably younger age group than that reported by other investigators and those cases of the Leonardo Martinez V. Hospital whose records were located and are described as the "old" cases in this study. A possible explanation for the greater percentage of patients in the younger age group between the new and the old patients may lie in the fact that

because of the overcrowded pediatric ward of the hospital, a child must be seriously ill before he is admitted to the hospital. Since drainage of the abscesses will give prompt resolution of the symptoms in almost all cases, many of these cases have been treated in the Emergency Room and no records have been kept of this treatment. Previous authors have not stated clearly whether their patient population represented a cross section of the existing population. Many of the physicians were associated with the colonial affairs and thus, especially the Army doctors, might have attended a selected population. In this way, children with the disease might have escaped detection. It is our opinion that, at least in San Pedro Sula, the disease is more common in children than has been reported. During the course of this study, it was of interest that the only physicians who were aware of the entity as a relatively common disease were the pediatricians.

Number of Abscesses per Patient

With the exception of Robertson (1930), who noted that most of the cases had abscesses in multiple sites, all of the investigators who have reported cases indicated that the solitary abscess is the most common form

of the disease. The following chart shows the percentage of patients and their corresponding number of abscesses:

<u>Author</u>	<u>Year</u>	<u>No. of abscesses</u>									
		<u>Cases</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7.....</u>	<u>10.....</u>	<u>21</u>
Sayers	1930	26	61.5	23.2	7.7	0	3.8	0	3.8	0	0
James	1931	10	40	20	10	0	10	0	0	10	10
Earle	1939	6	100	0	0	0	0	0	0	0	0
L-G&E	1943	20	65	35	0	0	0	0	0	0	0
Robin	1961	12	66.6	25	8.4	0	0	0	0	0	0
Ashken& Cook	1963	32	66	22	6	0	0	6	0	0	0
"old"		12	67	16.6	0	8.2	8.2	0	0	0	0
"new"		14	64.2	14.3	7.2	14.3	0	0	0	0	0

As can be seen, our results agree with those of other investigators. The number of lesions which the patient developed could not be correlated to age, sex, history of trauma or of a skin infection. Of the nine patients ("old" and "new") with multiple lesions, five had mixed suppurative-non-suppurative lesions, three had abscess formation in all of their lesions, and one had lesions that did not go on to abscess formation. The last patient received effective antistaphylococcal antibiotic treatment on the day of the onset of symptoms.

Location of the abscesses

The abscesses may be found in almost any muscle of the body, although the large muscles seem to be the

ones most often affected. Walker (1917) stated that "the parts most often affected are the great muscles of the extremities, especially of the thigh and calf, and the muscles of the trunk, abdomen, and chest. The muscles of the face, neck and hands are said to be exempt." Earle (1939) and Dennison and Dick (1944), however, report cases in which the sternocleidomastoid muscle was the seat of abscess formation. Buxton (1928) reported an abscess in one of the muscles of the hand. Robin (1961) said that the muscles involved were mostly those of the trunk and lower extremities. Other authors similarly seem to indicate that the lower extremities, glutei included, are most often involved. Of six abscesses in the same number of patients, Earle (1939) found that four of these had abscesses in the thighs. Others report:

<u>Author</u>	<u>% Abscesses in Lower Extremities</u>
Sayers.....	46
Leedham-Green and Evans	52
Traquair	45
Appel (from Traquair).....	53
Robertson	49
Buxton (from Traquair)	32
Ashken and Cook	50
"old"	66.5
"new"	40

The mean of the reported cases is 46%; the greater percentage of lower extremity involvement in the "old" series possibly represents the ambulatory disability that lower extremity lesions cause, thus perhaps leading the admitting physician to advise hospitalization in those cases. Other sites of abscess formation included the lumbar and abdominal musculature, scapular region, and bicep and tricep regions of the upper extremities. No lesions of the forearm, hand or head were seen. The possible relation of trauma or strain, to which the lower extremities are exposed, will be discussed under Trauma.

Bacteriology

Whether abscess formation will occur after the localization of bacteria in predisposed muscle will depend on largely unknown host factors, on the nature of the infecting organism, and perhaps on the treatment that the patient receives once his symptoms begin. Host factors which have been mentioned include the general state of health, especially nutritional status, antecedent or concurrent skin infection, and trauma to the affected region. These will be discussed in another section. Whether or not microfilaria and other local or constitutional factors play a role in

the pathogenesis has been seriously questioned, as was mentioned earlier.

The percentage of lesions which go on to abscess formation, once symptoms have begun, is variable throughout the years. Sayers (1930) noted that out of forty-six lesions there were twenty-three (50%) that eventually formed abscesses. Earle (1939) described six cases with one lesion each who were cured of their symptoms, presumably due to their being treated with a sulfa derivative; none of the lesions went on to abscess formation. Leedham-Green and Evans (1943) found that six out of the twenty-seven lesions (22%) were suppurative. Dennison and Dick (1944) noted that with no antibiotic treatment 80% of the lesions went on to abscess formation, but with sulphathiazole treatment the percentage of those that went on to abscess formation decreased to 50%. Ashken and Cook (1963) found that twenty-one of the thirty-two cases had suppurative myositis; there were thirty suppurative lesions (57%) and twenty-three lesions that never formed abscesses. Traquair (1947) noted that twenty-six of thirty-one cases (87%) had suppurative lesions.

Of the cases reviewed from the records of the Leonardo Martinez V. Hospital, there were a total of

twenty-one lesions, of which thirteen (62%) formed pus. These lesions were found in seven of the twelve patients (58%). Of the new cases, there were twenty-four lesions, of which fourteen (58%) had pus that was detectable. Only three of the "old" patients had both suppurative and non-suppurative lesions; the corresponding figure in the "new" cases was two. It appears, then, that over one-half of the patients seen in Honduras had suppurative lesions during the course of their disease, and less than one-half of all patients seen had either non-suppurative alone or mixed suppurative-non-suppurative lesions.

In the cases reported to date, it has not been clear when in the course of symptoms antistaphylococcal antibiotics were administered. It is possible that antistaphylococcal drugs, if administered early in the course of the disease, may prevent abscess formation, as may have occurred with cases 11 and 14 of the "new" series; once pus formation has occurred, drainage of the abscess cavity appears to be adequate treatment. Clearly, however, even without antistaphylococcal drugs, a number of abscesses (up to one-half, according to Sayers, who had no antibiotics in 1930) do not go on to detectable abscess formation. A controlled

study using two groups of patients, matched for duration of symptoms and using antibiotics in only one group, would be necessary to determine whether therapy is effective in influencing the course of the disease.

Leedham-Green and Evans (1943) listed the duration of symptoms before admission, the frequency of drainage and whether pus was obtained. Although he does not mention how long the patients were hospitalized before drainage, it is interesting to note that in only one of four cases that had symptoms for fourteen days (a long time in his series) was pus obtained. This suggests that it might not be possible to correlate duration of symptoms with the formation of pus.

Of the cases seen personally, duration of symptoms to the day of incision and drainage of pus varied from two days (case 2) to thirty days (case 4). Similarly, the duration of symptoms of those in whom no pus was found varied from one day (case 11) to twenty-one days (case 5), although the latter case had received some antibiotic treatment fourteen days after the beginning of her symptoms.

The bacteriology of the abscesses has revealed a variety of organisms: *Staphylococcus aureus*, *S.albus*,

hemolytic as well as non-hemolytic streptococci (Robin), coliforms, and *Proteus* (Cook). Scott (1912) described three cases in which he identified a Gram positive spore-forming rod, and in one culture reported "contamination" by staph and strep. Wise and Minnett (1913) described staph and strep as causative organisms. Walker (1917) noted three instances in which *Staph aureus* was the organism isolated; in another case the organism was *Staph albus*. Subsequent reports stressed the importance of the staphylococcus as the causative organism. Traquair (1947) found staphylococci in eighteen of nineteen samples of pus; Robin (1961) found *Staph aureus* in eleven of the twelve cases; Ashken and Cook (1963) recovered *Staph aureus* from all twenty-one samples of pus. Foster (1965) isolated *Staph aureus* in seventy-four of seventy-nine cases. He further found by phage typing that the strains isolated from the patients with Pyomyositis were not the same strains that were associated with miscellaneous hospital infections or those isolated from nasal carriers.

Of the cases reviewed in the Leonardo Martinez V. Hospital, bacteriological investigation was performed in four cases. The techniques were not des-

cribed; Staphylococci (coagulase positive) were isolated in two cases. The remaining two cultures did not reveal any organisms. Of the cases seen in the course of the summer, seven of the nine cultures of the pus obtained showed the only organism to be Staph aureus (coagulase positive), resistant to penicillin. Another culture revealed a mixture of Staph aureus and a Gram negative rod which was not identified further. The Gram stain of the smear made at the time of the incision and drainage had revealed the presence of only Gram positive cocci in clumps. The other culture revealed a Gram negative rod which on TSI agar proved to be a producer of gas and left an acid slant and an acid butt, as E.coli, A.aerogenes, Paracolon bacteria and Proteus vulgaris do. The organism was susceptible only to Neomycin and Kanamycin. No further identification was performed. The Gram stain of the smear made from the pus at the time of the incision had not demonstrated the presence of any organisms.

Robin (1961) found that nine of the eleven (82%) staph organisms isolated were resistant to penicillin. Cook (1963) found that in 1955-57, 81% of the staph isolated were resistant to penicillin; in 1961-62 the percentage of resistant organisms was 74%. Foster

(1965) found that a "high proportion" of organisms were penicillin-resistant and concluded that this resistance was not related to therapeutically administered penicillin because these strains differed from those generally found in the hospital environment. He suggested that penicillin resistance was a natural characteristic of these strains that were isolated from patients with tropical myositis. In the case of the organisms isolated in Honduras, this supposition does not have much basis, as penicillin can be and is frequently self-prescribed and purchased by the population. Prescriptions are not required by drug stores, and the population regards penicillin as a cure-all.

White Blood Counts

The blood counts of the patients with the disease have scarcely been mentioned by the authors. As is the case for the population at large in underdeveloped areas, most of the patients were anemic. Robertson (1930) reported that the disease caused a "moderate leukocytosis of 10,000 to 15,000 per cubic mm." Traquair (1947) noted the blood counts on five patients in whom pus was present as varying between 7,000 and

20,400, with the average being 12,000. Robin (1961), in twelve cases, listed white blood counts as between 7,000 and 18,500, with the average being 11,700 per cubic mm. Eosinophils varied between 0 and 27%, with only one count being above 10%. Ashken and Cook (1963) merely mentioned that the average leukocytosis was 15,300, with 70% polymorphonuclear leukocytes.

In the cases reviewed and seen in Honduras, the white counts ranged from 6,700 and 60,000 with the median 12,900, and the percentage of polymorphonuclear leukocytes ranged from 25 to 90. There was no correlation between the white count or percentage of polys and the number of abscesses, the age or sex of the patients or the duration of symptoms. Eosinophil counts varied between 0 and 38% (mean = 6.7%). Because stool examinations for ova and parasites were not performed, we cannot comment on the significance of the eosinophil counts.

Antecedent Skin Infection

It is generally believed that an interruption of the skin's continuity or the presence of a septic focus provides the portal for the entrance of the pyogenic organisms which eventually become localized in the

muscle that is somehow predisposed. Walker (1917) first mentioned the probability of skin sepsis leading to pyemia when he stated that a slight skin lesion may be overlooked or may be apparently healed before the pyemia develops. Robertson (1930) said that "most cases had either a carbuncle at the time of onset of symptoms, or before, or an infected skin abrasion." Fleming (1930) said that cutaneous sepsis or boils were "an almost invariable and recent antecedent." Chesterman (1930), in discussing the disease, said, "The disease as it exists in Equatorial Africa seems to be a cutaneous staphylococcal infection with ~~metastatic~~ inflammatory foci in muscle..." James (1931) described septic foci in his patients. Of the African patients that they saw during the war, Dennison and Dick (1944) noted that 30% suffered from an infected skin condition called Kraw-Kraw. Burkitt (1947) noted that "septic lesions, especially in the feet, are believed to be common foci." Of Traquair's patients (1947), six of thirty-one had a focus of infection. Ashken and Cook (1963) noted that "either focal or skin sepsis or pyorrhea was invariably present." Foster (1965), however, noted that a history or recent boils was rather rare in his series.

In the cases reviewed from the records of the

Leonardo Martinez V. Hospital, one can find three cases in which skin sepsis was mentioned as being present. A recent history of skin sepsis is not mentioned in any other case. Of the cases seen during the summer of 1967, we were able to elicit a history or find evidence of a skin infection in nine of the fourteen cases, although in many cases there were no grossly purulent lesions. Virtually all patients who had teeth had multiple caries.

With much of the population going barefoot most of the time, interruption of the skin's continuity is a commonplace occurrence and might not be remembered by the patient, and a small injury might be overlooked by the examining physician.

A study of the presence of skin sepsis at the same time of year and a study of the oral hygiene in patients with diseases other than Pyomyositis was not carried out. It is thus difficult to determine the significance of the relationship of a cutaneous or oral focus of infection with consequent seeding of the muscular tissue. Because of our limited bacteriological facilities, we found it impossible to determine if staphylococci of the same phage type could be recovered from the skin lesions as were isolated from

the abscesses.

Trauma

Of the multiple factors that might lead to bacterial localization in the muscles, such as microfilarial infection, thrombophlebitis, sickle cell disease, leptospirosis, trauma, and vascular fragility due to subclinical scurvy, the last two have not been disproven and deserve some comment.

Surprisingly little has been said about trauma as a possible etiological agent. Chesterman (1930) suggested that "strain or external violence" might predispose a muscle to infection. Dennison and Dick (1944) stated that a "definite history" of injury to the affected region was rarely available. In 1947, Burkitt said that nine out of fifty patients gave a history of trauma to the affected area. In the same year, Traquair described a case in which trauma had occurred. He also quoted the conclusion of Miyake, a Japanese investigator who in 1904 performed experimental work that indicated that some form of trauma led to the localization of pyogenic organisms in muscle. Robin (1961) noted that two out of twelve patients gave a history of preceding trauma.

Ashken and Cook (1963) mentioned that among the

recruits in whom he studied the disease, trauma was a commonplace occurrence. It was our experience that the same could be said for most of the young people who are affected with the disease. While interviewing individual patients, it was apparent that they often tried to implicate trauma to the region as a cause, and often would go so far as to say that they had injured the affected area up to two years before. In the cases reviewed from the records, only one patient gave an account of trauma (a fall from a horse) two weeks before admission to the hospital. He claimed that the pain in one of the regions of abscess formation had begun at the time of the fall and as a direct result of it. Of the patients seen personally, four complained of trauma, not necessarily to the affected area alone. Often, as in cases 1-3, this trauma was revealed by the child and could not be substantiated by an adult.

Nutrition

The role of nutritional deficiency in the etiology of Pyomyositis Tropicans has been entertained. Earle (1939) suggested that "avitaminosis" might be significant. Traquair (1947) said that vitamin deficiency was probably important. Young and Clark (1940) des-

cribed thirty-one cases of an afebrile, non-suppurative myositis that developed in some recruited laborers who had been on a vitamin C. deficient diet for three to four months. These patients developed brawny induration of the muscles of the lower extremities which, when examined surgically, proved to be a "hemorrhagic myositis" which the authors attributed to a vitamin C deficient state in individuals who did not yet have bleeding gums and other signs and symptoms more classically attributed to scurvy. The authors attributed the localization of the pathology in the lower extremities to "stress" in that region. In 1943 Wiseman described an outbreak of a non-suppurative myositis among prisoners who had been on a vitamin C deficient diet for about five months. The lesions were again localized to the lower extremities; in these cases, however, the patients were febrile. Two white blood counts given were below 11,000 per cubic mm. These patients had no bleeding from the gums or other signs or symptoms of scurvy. The condition cleared with vitamin C supplementation. The author discusses the difficulty in distinguishing between this manifestation of scurvy and non-suppurative myositis. In 1963, Ashken and Cotton presented thirty-two cases of suppurative and non-suppurative myositis in Gurkha

recruits in Malaya and presented the hypothesis that repeated minor trauma to muscles led to the formation of small hematomata due to the increased vascular fragility in patients with subclinical scurvy. These hematomata then became seeded with pyogenic organisms as a result of transient bacteremias. These lesions then went on to develop into either suppurative or non-suppurative forms of tropical myositis. The authors noted that the regions most exposed to repeated minor trauma, the lower extremities and the right side of the body were the regions where the lesions were predominantly found. They showed that the Gurkhas with the disease required a greater time for vitamin C saturation than "normal" Gurkhas.

Citrus fruits abound in the Sula Valley, and it is difficult to see how, unless one had peculiar dietary habits, one would find oneself in the vitamin C depleted state. Citrus fruits are available on trees which are growing wild throughout the entire fertile valley; in the city there are oranges to be found everywhere; indeed, because of their availability and low cost, oranges are consumed in much the same way as soft drinks are consumed in this country. Each patient was asked whether he ate citrus fruits or whether he

had some dietary peculiarities that other members of the family did not have. The parents of case 14 were the only ones that said that their child was not given any fresh fruits as a rule. No signs of scurvy could be elicited in this child. The other patients said that they regularly ate citrus fruits. Case 7 actually lived on one of the orange groves. There was no gross evidence of other vitamin deficiency in these patients. Although kwashiorkor is seen frequently, especially in the pediatric population, none of the patients with Pyomyositis had the condition.

SUMMARY AND CONCLUSIONS

Twelve cases of Pyomyositis Tropicans were reviewed from the records of the Leonardo Martinez V. Hospital in San Pedro Sula, Honduras. Fourteen cases of the disease were seen during the course of the summer of 1967. A study of the classifications such as age and sex of the patients, number and location of the lesions, and antecedent trauma and possible dietary abnormalities as possible factors was carried out. The bacteriology and a study of the presence of skin sepsis as a possible portal of entry were done. The results indicate that except for the age distribution of the patients, the two groups were similar. Possible explanations for the discrepancy in the ages are presented. The patients reviewed and seen seem to correlate with what other authors have reported.

Pyomyositis Tropicans is a disease that is seen mostly in young males who present with one lesion but sometimes with more than one. About one-half of the lesions seem to occur in the lower extremities. More than half of the lesions go on to abscess formation. In the majority of the cases *Staphylococcus aureus*, coagulase positive and probably from a cutaneous

source, is the organism that is recovered from the pus.

There does not seem to be any way of determining whether a given lesion will go on to abscess formation or will resolve spontaneously. There is no relationship between the age of the patient and the number of lesions with which they will present, although our two oldest patients (cases 4 and 11) had multiple lesions. The white counts did not reflect the extent of involvement or the duration of the symptoms.

What the factor or factors are that render a muscle susceptible to infection is not known. Trauma has been implicated but is difficult to prove conclusively. Dietary deficiency has also been mentioned as a possible factor in the pathogenesis. Whether a vitamin C deficient diet is responsible for the muscular predisposition is seriously doubted. A specific dietary deficiency would be most difficult to demonstrate in an underdeveloped area where the population subsists on a diet deficient in many factors.

The problems facing one who would do research on this entity are staggering. It is hoped that further work will be done to investigate the nature of this fascinating disease which, though almost never fatal,

is nevertheless associated with a great deal of morbidity for the patient.

APPENDIX A Form Used for History, Physical Exam and Course

Date _____ Unit Number _____

Name	Age	Sex
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Home Address

Occupation

History of Present Illness

Fever	Chills
Pain	
Limitation of use of the muscle(s) affected	
Cough	Dysuria

Treatment received to date of first visit

Antecedents

Skin Infection	Recent or current
Trauma	Nature of the trauma
Pharyngitis	Recent or current
Other diseases:	

Diabetes
Recent childbirth
Renal Disease
Liver disease
Others

Has the patient experienced these symptoms before?
Are there other members of the family similarly ill?
Do any family members have skin infections?
Peculiar dietary habits? Does the patient eat citrus
fruits?

Review of Systems, including development

Physical Exam

Temperature	oral rectal	Pulse
<u>Oral cavity</u>	Dental caries Hypertrophic tonsils	
<u>Skin</u>	Evidence of current or recent skin infection	
<u>Lymph nodes</u>	location of enlarged nodes	

Number of lesions:

Lesion no. (1)	(2)	(3)	(4)
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Location:SizeConsistencyPainfulDrainingFluctuantIncreased temp of
overlying skinErythema of skinIs overlying skin bound down?CBCUrineX-rayGram stain of pus and result of culture and sensitivityEvolution (Progress notes)

APPENDIX B

Old Cases

1. C.R.P. (51358), a 10 year old male from an outlying town, was admitted to the LMV Hospital because of steadily increasing pain in the posterior aspect of the right thigh, of one month's duration. Eight days before admission, a cough had developed. His past history was unremarkable. On admission, his temperature was 38.8°C. His right thigh was swollen and hard, with fluctuation in the middle third of the thigh. His hemoglobin was 10.6 gms., RBC 3,150,000 per cu. mm., WBC 7,550 with PMN 25%, L 72%, Eos 3%. The abscess was opened and 80 cc of pus was evacuated. He was given Procaine penicillin 800,000 units twice a day. His temperature fell to normal and he remained afebrile thereafter. Six days later the penicillin was discontinued and the patient was discharged.
2. M.J. (38825), a 10 year old female, was admitted to the LMV Hospital because of steadily increasing pain in the right lower quadrant of the abdomen of ten days' duration. The pain was worse with

movement and when the patient assumed the right lateral decubitus position. She had had an unquantified fever but no shaking chills. Two days after the onset of the pain, she developed a mass in her right lumbar region. She had recently developed a cough productive of yellow sputum. The patient had had approximately six attacks of "tonsillitis" per year. Her feeding habits had been good; her father and two brothers were in good health. Temperature was $37.7^{\circ}\text{C}.$, pulse 100, B.P. 90/70. She weighed 50 lbs. Her pharynx was not injected; she had no lymphadenopathy. There was a hard, painful mass in the right lumbar area at the level of the fourth or fifth lumbar vertebra. Her hemoglobin was 8.5 gms, RBC 2,860,000, WBC 13,950 with PMN 72%, L 26%, M 2%. She was given 800,000 units of penicillin twice a day and was also treated with sulphadiazine for ten days. On day 13, the mass had almost disappeared; there was no suppuration. The patient was asymptomatic and was discharged.

3. C.C.A. (43090), a 2 year old male from an outlying town, was admitted to the LMV Hospital because of

a hard, painful mass in the right lower quadrant of the abdomen and fever of eight days' duration. The patient had just recovered from a bout of gastroenteritis manifested by diarrhea, generalized abdominal pain, and fever. Three days before admission, the patient had developed rhinorrhea and a productive cough. The patient was an only child. He had been breast fed for the first 15 months and had received cow's milk for the following one month; his subsequent diet was also poor in protein. Temperature was 39°C. (rectal); pulse was 120 per minute. The pharynx was injected. The tonsils were hypertrophic. His abdomen was soft with normal reflexes except in the right lower quadrant, where he complained of pain on palpation. A hard, non-fluctuant mass with diffuse borders was palpated. There was active peristalsis; rectal examination was negative. He was treated with penicillin and chloramphenicol. Six days later the patient was afebrile; the mass was smaller and had well defined borders, and the patient was discharged.

4. A.M.B. (36968), a 12 year old male, was admitted to the LMV Hospital because of a hot, swollen,

painful left thigh of eight days' duration. His temperature was 39°C. His left thigh was hot, swollen, and painful, and there was an indurated zone medially. There were cutaneous evidences of recent furunculosis, although none were observed over the site of the lesion. Hemoglobin was 11 gms; RBC 3,730,000; WBC 13,050 with PMN 79%, L 19%, Eos 2%. A diagnosis of myositis of the left thigh was made, and he was given a ten day course of penicillin and streptomycin. Four days after the initiation of treatment, his fever was gone. He was discharged ten days after admission, by which time the induration and pain had disappeared.

5. A.P.H. (37543), a 9 year old female, was admitted to the LMV Hospital because of pain of three days' duration in the right flank, steadily increasing and radiating to the right hemithorax, right iliac fossa, and right thigh. One day before admission the pain intensified severely and the patient began vomiting. She had been well previously. Her temperature was 40°C. The tonsils

were hypertrophic and congested; the pharynx was injected. Lymph nodes were palpable in the submaxillary and right axillary regions. There was tenderness to palpation in the epigastrium, in the right upper quadrant, and in the right lower quadrant. Hemoglobin was 9.5 gms, RBC 2,950,000, WBC 11,750 with PMN 65%, L 30%, Eos 5%. Penicillin was started. On the following day, the attending physician noted localized inflammation in the right thigh. Repeated films of the right hip joint and femur were negative for osteomyelitis. The temperature remained around 38°C. for several days and then dropped to normal. Antibiotics were discontinued and the patient was discharged asymptomatic.

6. J.O.S. (30581), a 34 year old female, was admitted to the LMV Hospital because of steadily increasing pain in the inner aspect of the right thigh. She noticed no swelling but had fever. Temperature on admission was 38.4°C., B.P. 110/70. She had difficulty walking. A mass was palpated in the middle one-third of the inner aspect of the right thigh. A diagnosis of myositis with abscess was

made. Hemoglobin was 9.5 gms, RBC 3,000,000, WBC 10,050, with PMN 74%, L 15%, M.2% Eos 9%. Urine specific gravity was 1.021, pH acid, and there was no protein, glucose, or cells. X-rays of the right femur showed no osteomyelitis. Penicillin and Streptomycin were started. On the second hospital day, the mass was incised but no pus was obtained. A drain was left in place. On the third hospital day her temperature rose to 40.2°C. but dropped to normal on the fifth hospital day. Antibiotics were discontinued on the following day and the patient was discharged with her symptoms relieved.

7. P.H.J. (58576), an 8 year old male, had fallen off a horse two weeks before being admitted to the LMV Hospital. At the time of his fall, some pieces of firewood that he was carrying had fallen on him. Pain persisted in the left costal region. Six days before admission, he noted fever, increasing pain and the appearance of a painful, ovoid mass. He also noted pain in his left hip to the point that sitting down became impossible. On admission, the temperature was 39°C.; the pulse was 120 per minute. There was a soft, painful mass

8 cm x 10 on the lateral aspect of the left costal region. He also had a painful left gluteal region. X-rays of the thorax and hip were negative for bony involvement. The patient was started on penicillin. The thoracic abscess was drained on the first day. The penicillin was discontinued and was substituted by dicloxacillin. On the second day it became obvious that there were abscesses in the left gluteal region and in the right thigh. These were drained on the sixth hospital day, yielding 60 cc and 50 cc of pus, respectively. On the seventh day, another abscess in the anterior abdominal wall was drained. On the eighth day the patient was afebrile, but fever returned on the ninth day. Chloramphenicol was added to the antibiotic regimen. On the fourteenth hospital day the dicloxacillin was discontinued. He remained afebrile until the twenty first hospital day, when fever again appeared, and a small swelling was noted in his left thigh. Penicillin was administered once again. Two days later the mass was noted to be almost gone. Five days after penicillin had been restarted

the patient was afebrile and was discharged two days later, twenty-six days after having been admitted to the hospital.

8. I.U.P. (43512), a 22 year old male field hand, was admitted to the LMV Hospital because of three days of intermittent shaking chills, fever, and generalized aches and pains. On physical exam, the temperature was 39°C, the pulse was 100 per minute, and the blood pressure was 120/70. The right thigh was noted to be increased in size, with rigidity that extended into the gluteal area. There was a furuncle noted in the posterior aspect of the left thigh. Hemoglobin was 12.5 gms, RBC 4,200,000, WBC 19,100 with PMN 92%, L 8%. Urine had an acid pH, trace protein, no glucose and rare white cells per high power field. The patient was started on penicillin and by the third hospital day the temperature was normal. On the fifth hospital day the posterior aspect of the right gluteal region was incised and the pus was sent to the laboratory. Bacteriological culture was negative for organisms; many leukocytes were

seen on smear. Antibiotics were discontinued and the patient was discharged on the thirteenth hospital day.

9. M.J.R. (43223), a 25 year old field worker, was admitted to the LMV Hospital because of eight days of pain in the right thigh, fever, and inability to walk or lie on the right side. Two days before admission he had begun to have a productive cough and rhinorrhea. His past medical history was of significance only in that five years ago he had had a polyarthrititis without fever that had resolved without treatment. Eight months before admission he had received treatment for "chancre". His temperature was 38.8°C., pulse was 100 per minute, blood pressure 120/80. His right thigh was swollen, erythematous, and was painful in active and passive motion. Hemoglobin was 12 gms, RBC 4,310,000, WBC 11,900 with PMN 76%, L 18%, Eos 6%. VDRL was negative. Penicillin was begun, and the abscess was drained. Staphylococcus aureus was grown from the pus. Two days after incision and drainage, the temperature was normal. Repeat blood count five days post

drainage showed a WBC of 9,900 with PMN 71%, L 27%, Eos 2%. On the tenth day penicillin was discontinued, and the patient was discharged asymptomatic on the fourteenth day.

10. E.A. (44781), a 38 year old field hand, was admitted to the LMV Hospital because of increasing pain and disability of four days' duration in the left thigh and right gluteal area and pain in both upper extremities developing on the day of admission. Eight days before admission, the patient had developed a furuncle on his back at the lumbar area. He denied any previous illnesses and had not received any medical treatment. Temperature was 39.5°C., pulse was 100 per minute, and the blood pressure was 110/90. There was a 3 cm x 3 cm "ulcer" in the lumbar region in the midline. There was pain and rigidity in the thighs bilaterally, as well as pain in the upper extremities. Hemoglobin was 13 gms.; RBC 4,310,000, WBC 12,750 with PMN 81%, L 17%, Eos 2%. Urine showed 2+ glycosuria but no protein or acetone. There were five white cells per high power field.

The patient was given penicillin by the intravenous route but continued to have an elevated temperature. Penicillin-resistant *Staphylococcus aureus* were recovered from the furuncle. Blood cultures were negative. The patient became disoriented. Chloramphenicol was begun and the temperature fell to normal. Two abscesses were drained (one week apart) in the right gluteal area. Chloramphenicol was discontinued after one week and tetracycline was begun. The patient was discharged on the thirty-fourth hospital day.

11. A.M.M. (48811), a 20 year old field worker, was admitted to the LMV Hospital because of one week's progression of pain and swelling in the left pectoral muscle, right lumbar muscles, right buttock and right thigh. Temperature was 37.6°C., pulse was 88 per minute, blood pressure was 100/70. Hemoglobin was 13.8 gms. the hematocrit was 42%. Urine showed an acid urine without glucose, protein, or cells. An abscess in the right arm was drained. Coagulase positive *Staphylococcus aureus* was recovered from the pus. Blood cultures

were negative for bacteria. The patient's temperature reached $39.5^{\circ}\text{C}.$, and he was started on penicillin. On the tenth hospital day abscesses in the left and right gluteal regions were drained. *Staphylococcus aureus* was recovered from both sites. On the following day, the mass in the left thigh was incised but only sanguinous fluid was obtained. Following these procedures, the patient became afebrile and was discharged on the eighteenth hospital day.

12. L.G.G. (51624), a 24 year old field hand, was admitted to the LMV Hospital because of seven days of fever and muscle and joint pains. He had warm, slightly painful masses in the right scapular region and in the posterior aspect of the neck. He claimed to have been "vaccinated" immediately before the onset of his symptoms, but the site of the "vaccination" was not stated. His temperature was $39^{\circ}\text{C}.$, blood pressure was 120/70. He had carious teeth, a slightly painful, non fluctuant mass in the posterior aspect of his neck, and a painful, warm, fluctuant mass in the right scapular area. He had joint

pains in his extremities. Hemoglobin was 11.6 gms., RBC 3,950,000, WBC 6,700 with PMN 54%, L 42%, Eos 4%. Urine was negative for protein and glucose; there were four white blood cells per high power field. On the second hospital day his right scapular mass was incised and ten cc. of pus was obtained. He was given penicillin. Culture of the pus was sterile. The temperature slowly returned to normal and the patient was discharged on the eighteenth hospital day. No further mention was made of the mass in the posterior neck.

APPENDIX C Cases seen personally

1. D.E.S. (4381), an eleven year old female, was admitted to the La Lima Hospital because of a painful, swollen, left calf. Six days before admission, she had fallen on her left leg while running, but had not lacerated the skin. She had no history of skin, teeth, or pharyngeal infections. There was no family history of a similar condition. Hemoglobin was 10.5 gms, WBC 21,750 (PMN 95%, L 5%). Urine, pH acid, specific gravity 1.021, negative tests for protein and glucose. The sediment showed 10-20 WBC/HPF. X-rays of the leg and ankle did not show signs of osteomyelitis. The temperature was 38.2°C. On the third hospital day, the temperature reached 40.5°C. The patient was started on penicillin. On the fourth hospital day, incision and drainage of a mass in her left calf was carried out and bloody, purulent material was evacuated. The temperature promptly fell to normal and the patient was subsequently discharged. Culture of the wound drainage on the third post operative day revealed Staphylococcus aureus, coagulase positive, resistant to penicillin.



Case 1

2. P.M. (4445), a nine year old school boy from a banana plantation, was admitted to the La Lima Hospital on June 10, 1967. Two days before admission he had fallen and had twisted both lower limbs. He was given massages by a family friend. He complained of increasing pain and swelling of his right ankle and dorsal aspect of his left foot. He had had no cough nor history of a recent skin infection. Admission temperature was 40.2°C . Hemoglobin 13.1 gms; urine, specific gravity 1.020, 2+ protein. He was started on penicillin. On the

first hospital day his temperature dropped to 37.2°C . but the next day rose to 40.5°C . He was taken to the operating room and a subcutaneous abscess on the dorsal aspect of the left foot was incised and drained. Postoperatively his temperature dropped to 37.5°C - 38.5°C . but on the third post operative day it rose again to 40.5°C . He was taken to the operating room and a muscular abscess in his right calf was drained. Temperature dropped to normal and remained so. Antibiotics were discontinued and he was discharged on the fifth day after the second drainage. A culture taken from the right calf on the second day after drainage revealed the presence of *Staphylococcus aureus*, coagulase positive, and resistant to penicillin.



3. N.O.P. (78375), a five year old girl, was first seen at the LMV Hospital on 14 June, because of pain in the right thigh, which made walking difficult. She reported that she had fallen while running three days before this date. She had been seen in the out patient department on 16 May for a scalp infection and had received penicillin. On examination, there was a 4cm x 4cm painful, non-fluctuant mass in the middle one-third of the right thigh. The skin over the mass was warm. The thigh was swollen. The oral temperature was 38.7°C. The hematocrit was 34%, WBC 13,900 (PMN 63%, L 34%, Eos 3%). X-ray showed no evidence of osteomyelitis. She was advised to take aspirin for fever and was seen daily. On 17 June she was started on penicillin therapy. Fever persisted, and on 23 June, 20 cc of pus were drained from a muscular abscess. The temperature immediately after drainage was 38.5°C., WBC 17,250 (PMN 68%, L 25%, M 3%, Eos 4%). She was admitted to the hospital, and the temperature promptly fell to normal. Smear of the pus showed gram positive cocci. Staphylococcus aureus, coagulase positive and resistant to penicillin

were recovered from the pus. Antibiotics were discontinued and the patient was discharged on 26 June. She was well when seen in the clinic one week later.

4. M.M. (81181), a twenty nine year old rural housewife, came to the LMV Hospital with warm, fluctuant masses in the left biceps, left thigh, right triceps, and left lumbar regions. These had developed over the preceding month, having started with pain, then becoming hard, painful swellings in the involved areas. She had had fever and had received four penicillin injections before coming to the hospital. There was no history of preceding trauma or skin infection.

On examination, the temperature was 37.8°C. RBC 2,820,000, WBC 11,300 (PMN 65%, bands 16%, L 13%, M 2%, Eos 4%). Urinalyses was normal. X-rays revealed no evidence of osteomyelitis. The abscesses were drained on the day of admission, with the removal of 400 cc of pus from the left thigh, 100 cc from both the lumbar region and right arm, and 50 cc from the left arm. Smear of the pus showed gram positive cocci in clumps. Culture revealed the

presence of *Staphylococcus aureus*, coagulase positive and resistant to penicillin. She received penicillin for four days, and, once the sensitivities were obtained, antibiotics were discontinued. She was afebrile on the second day after drainage. She was discharged on 26 June. Because of an area of induration and warmth of the skin over the left thigh at the site of the abscess, she was given Erythromycin to take at home for six days.



Case 4: Abscess



Case 4: Left Thigh and Pus Drained



Case 4: Abscesses, Left Biceps and Right Triceps

Case 6: 1980-1981, Left: 1980-1981, Right: 1981-1982

5. M.E.S., a six year old girl, was first seen on 19 June because of a hard, painful mass in the left lower quadrant of the abdomen. She had felt generalized abdominal pain one month before. One week later, the pain had localized in the left lower quadrant, and the mass had appeared three days later. Two weeks before being seen, she received two penicillin injections. Her mother had noted fever during the preceding three days but had not taken the child's temperature. The child had had boils on her skin during the preceding three months.

On examination, the patient had a 4 cm x 4 cm hard, painful mass in the left lower quadrant just medial to the iliac crest. The temperature was 37.5°C (rectal). Hemoglobin was 8.2 gms., hematocrit 31%, WBC 18,200 (PMN 48%, Band 2 %, L 26%, M 2%, Eos 22%). A needle aspiration of the mass was attempted but no pus was obtained. On 20 June, penicillin therapy was begun, and she was advised to apply warm packs to the region of the mass. She was next seen on 23 June. The mother said that the child had had no fever. The temperature was 37.5°C (oral). The mass appeared

to be diminishing in size. No fluctuation was felt. The penicillin treatment was continued. On 26 June the child was afebrile. The mass had diminished to 2 cm x 2 cm in size. On 30 June antibiotics were discontinued, and on 5 July the mass was only barely palpable.

6. E.C.B. (83012), a fifteen year old school girl from a neighboring village, had developed a furuncle on her right knee. It had been manipulated by her sister ten days before admission. Two days later she had developed a fever. Three days before admission she began noting pain in her left gluteal region; this pain had been increasing in intensity and was accompanied by swelling of the region.

On admission to the LMV Hospital on 7 July, her temperature was 39°C, pulse was 100 and blood pressure was 110/80. The furuncle on the right knee was still draining purulent material. The left gluteal region was enlarged; there was an 8 cm x 8 cm hard, painful, warm mass palpated. No fluctuation was felt. WBC was 28,500 (PMN 78%, bands 2%, L 13%, M 2%, Eos 5%). The urine



had a specific gravity of 1.018, pH acid, no protein, sugar, or cells. X-ray of the pelvis was negative for osteomyelitis.

With aspirin treatment, the temperature fell to 37.5°C on the day of admission. On the following day penicillin therapy was begun, despite which she continued to have daily afternoon temperatures of 39°C. On 11 July, fluctuation became apparent, and on 13 July, 70 cc of green bloody pus was drained from the gluteal region. No organisms were seen on direct smear. H₂S-producing Gram negative rods, which on TSI agar had the characteristics of *Proteus* species or of coliform bacilli, were grown from the culture medium. These organisms were sensitive only to Neomycin and Kanamycin. On July 15 she was afebrile and remained so thereafter. On 17 July her white count was 13,350 with 53% polymorphonuclear lymphocytes. She was discharged on 18 July, eleven days after admission and five days after drainage of the abscess.



Case 6: Needle aspiration of gluteal abscess

7. M.S. (84201), a two year old male child from an orange grove, was admitted to the LMV Hospital on 18 July because of eight days of swelling in the right deltoid and left calf regions. He had had fever during these days and had received four penicillin injections in the buttocks before coming to the hospital. He had had varicella four months before, and currently had a scalp infection.

On admission, his temperature was 38.2°C

(rectal). He had palpable lymph nodes in his right axilla. There was a 3 cm x 4 cm hard, painful, non-fluctuant mass in the right deltoid region and a 4 cm x 4 cm hard, painful, nonfluctuant mass in his left calf. The overlying skin was warm in both places but was bound down only over the deltoid mass. The hematocrit was 33%, WBC 30,500 (PMN 76%, bands 2%, L 20%, M 2%).

Penicillin therapy was begun. That afternoon his temperature fell to 37.5°C. and remained below 38°C thereafter. On 21 July a subcutaneous abscess was drained in the right deltoid region. Ten cc of pus were evacuated. A stained smear showed Gram positive cocci in clumps. Coagulase positive *Staphylococcus aureus*, resistant to penicillin, were grown from the culture. By measurements, the inflammation in the left calf was subsiding. On 22 July there was no longer any heat felt over the swelling in the left leg. WBC was 15,850. The patient developed diarrhea and was treated with sulfa. On 24 July there was essentially no difference in calf measurements, and the patient was considered to be cured.



Case 7: A Subcutaneous Abscess

8. M.J.G. (84646), a nineteen month old male child from an outlying town, was admitted to the LMV Hospital on 24 July because of a mass which had appeared in the right lumbar region eight days before. One month before admission he had developed a fever, presumably associated with measles. The fever had not disappeared by the time the lumbar mass was noted. He received four penicillin injections before it became apparent that he had measles. Over the preceding three months he had also had a skin infection. At the time of admission

he had an upper respiratory tract infection.

On admission, his temperature was 38°C (rectal); his pulse was 148 per minute. The lumbar mass measured 6 cm x 6 cm and was painful. There was fluctuation. The hemoglobin was 8.4 gms, hematocrit 27%, WBC 18,800 (PMN 31%, L 62%, M 6%, B 1%). On the day of admission, 40 cc of pus were drained from a muscular abscess in the right lumbar region. A Gram stain of the smear showed Gram positive cocci in clumps. The culture revealed the presence of coagulase positive *Staphylococcus aureus* and a Gram negative rod. Individual sensitivities were not determined. On 26 July, because of a temperature of 38°C, the patient was given penicillin and sulfa. On 28 July, his temperature had fallen to normal and he was discharged.

9. C.O.R., a five year old male from the city, was referred to us on 28 July because of a mass just medial to his left scapula. Approximately four weeks before, he had developed a scalp infection, with fever and lymphadenopathy. He had received five penicillin injections at that time. On 23

July his mother noted the appearance of this painful mass in his back.

His temperature was 38°C (oral), pulse was 120 per minute. There was evidence of a recent scalp infection, and he had a small amount of cervical adenopathy. He had a hard, painful, mass which measured 5 cm x 5 cm just medial to his left scapula. Some observers felt that fluctuation was present. Incision was performed but no pus was obtained. He was given penicillin therapy on an outpatient basis and was next seen on 2 August. On that date his hematocrit was 33%, WBC 10,100 (PMN 60%, L 13%, M 13%, Eos 14%). Incision was again performed but no pus was obtained. At this point, penicillin was discontinued and he was started on therapy with erythromycin. On 8 August the mass was no longer palpable, but the cervical adenopathy was more marked, especially in the left posterior cervical triangle. Erythromycin was continued, and when seen again on 14 August, the adenopathy had also disappeared.

10. J.R.M., a four year old male, was first seen on 16 August because of ten days of fever and eight

days' onset of a painful swelling in his left scapular region. He had received two penicillin injections. He had no history of trauma to the region, and he had had no recent skin infection, although a brother currently had a skin infection.

His temperature was 38.2°C (oral), and his pulse was 120 per minute. The mass measured 8 cm x 6 cm, was painful, somewhat hard, and hot. Several examiners could not agree upon the presence of fluctuation. Erythromycin therapy was begun. On 17 August, fluctuation was felt to be present, and 30 cc of bloody pus were drained from a muscular abscess. A smear of the pus showed Gram positive cocci in clumps; *Staphylococcus aureus*, coagulase positive and resistant to penicillin, was grown on culture. At the time of the drainage of the abscess, the white blood count was 24,250 (PMN 53%, L 34%, M 3%, Eos 10%). Immediately after drainage, the erythromycin was discontinued. Five days later, the patient was afebrile and asymptomatic. The white blood count was 13,450.



Case 10

11. A.F.R. (87401), a twenty six year old married construction worker, was admitted to the LMV Hospital on 16 August because of a painful swelling in his right scapular region, right gluteus, and both calves. He had been perfectly well until two days before admission, when he suddenly awoke at one a.m. with pain in all of the regions described above. One month before admission, he had had a boil on his right forearm which had required incision and drainage.



At the time of admission, he was also complaining of nausea. He had received two penicillin injections, the last one being on the day of admission. Review of systems was non-contributory, except for the fact that he had been hospitalized seven years before, in the capital city, for what he described as rheumatism and sinusitis. At that time he had been told to receive one long acting penicillin injection every six months, but he had not followed these instructions.

On examination, his temperature was 36.5°C , pulse was 80 per minute and regular, and the blood pressure was 130/88. No heart murmurs were heard. The above-mentioned areas were all grossly swollen, hard, and painful. The skin over the right gluteus and right infrascapular regions was warm to the touch. There was no fluctuation detected in any area. The WBC was 11, 400 (PMN 66%, L 29%, M 5%). Penicillin and erythromycin therapy was instituted. At the insistence of some advisors, exploratory incision of the right gluteus was carried out but no pus was found. On the second hospital day the pain had diminished considerably.



On the fifth hospital day the swelling had diminished, and the patient was discharged. He had been afebrile throughout his hospital course. He was followed in the outpatient clinic, on erythromycin therapy. The areas of swelling returned to their normal sizes.

12. R.E.M. (87534), a six year old white male schoolchild from another town, was admitted to the IMV Hospital on 21 August because of fever, pain and swelling in his right lumbar region. Two weeks before admission the child had a furuncle manipulated, with expression of pus. The furuncle had been on his frontal region. The following day he began to have fever. A physician began dicloxacillin therapy for four days without relief of the fever and then discontinued the semi synthetic penicillin and commenced procaine penicillin therapy. Five days before admission, a mass on his right lumbar region appeared. Urine on that day showed a trace of protein and occasional granular casts, so the patient was given Furadantin and Gantrisin. On the day of admission, with the child's



lumbar mass persisting and increasing in size, the mother consulted another physician and the child was hospitalized. Shortly after admission, the child had a temperature of 39°C . On examination, he had a 6 cm x 6 cm hard, painful, warm mass on his right lumbar region. Oxacillin therapy was started. On the third day of treatment, the child was afebrile and the mass was no longer visible and just barely palpable, but the overlying skin continued to be warm. The patient reported almost no pain on palpation at this time.

13. M.D., a seven year old male from an outlying village, was first seen at the IMV Hospital on 22 August. Ten days before, he had begun to have fever and pain in the right leg. Three days before being seen, he had been started on a two day course of penicillin therapy but afternoon fever had persisted. The child had not hurt his leg or abdomen. He had a dermatophytic infection of the regions between his toes, which had been present for three months but which had not bothered him, except for the pruritis. Three

brothers had skin infections.

On examination, the temperature was 37.5°C and the pulse was 92 per minute. The child could not stand by himself, as he maintained his right thigh in the position of flexion and internal rotation. The thigh was not swollen or hot. The child complained of exquisite pain when passive extension of the thigh was attempted. There was minimal inguinal lymphadenopathy. The x-ray of the pelvis and joint showed no evidence of bone pathology. A myositis of the psoas muscle was suspected.

Erythromycin therapy was begun. Two days later the patient was much improved, now being able to stand by himself in almost a fully erect position, although extension of the thigh was still painful. The father related that the boy had had no obvious fever since the beginning of the erythromycin therapy. A blood count on that day showed an RBC 3,700,000, WBC 6,800 (PMN 26%, L 22%, M 14%, Eos 38%). Because the father had to return to the remote village where he lived and was unwilling to leave the child at the hospital, the patient was discharged with a one



week's supply of erythromycin and was lost to followup.

14. S.S. (86648), an eighteen month old male, was admitted to the LMV Hospital because of fever and left axillary, right scapular, and anterior abdominal wall masses. Thirteen days before admission, the child was noted to have fever. Two days later the mother noted a small mass on his left anterior abdominal wall. Three days thereafter, simultaneous masses appeared on the posterior axillary wall on the left and on the infrascapular region on the right. The fever continued. The child had received penicillin for five days, the last dose having been administered two days before admission.

Two days before the beginning of the fever, the child had fallen from a chair. He had had no skin infection. The diet was unusual in that the child received no fresh fruits in his meals. He was an only child.

Temperature on the day of admission was 38°C (rectal), pulse was 160 per minute. The left axillary abscess measured 4 cm x 4 cm and



was soft, fluctuant, warm, and painful. The right infraspinatus lesion was the same size and had the same characteristics. There was a 2 cm x 2 cm hard, non fluctuant warm, painful mass on the left anterior abdominal wall. The hematocrit was 35%, WBC 60,000 (PMN 66%, bands 6%, L 16%, M 7%, Eos 2%). The patient was started on penicillin. On the second hospital day, the axillary and scapular abscesses were drained. A smear of the pus, stained by the Gram method, showed Gram positive cocci in clumps. Coagulase positive Staphylococcus aureus, resistant to penicillin, was grown from the culture. The temperature remained between 38° and 38.5°C. Two days later the abdominal mass had not changed in characteristics; the WBC was 24,250 (PMN 76%). On the fourth post-operative day, the fever and abdominal mass were unchanged. Erythromycin therapy was instituted. The next day the temperature fell to 37.5°C. The child was discharged on that medication and was instructed to return to the clinic in five days for further examination. The child did not return.



BIBLIOGRAPHY

1. Ashken, M.H. and Cotton, R.E. Tropical Skeletal Muscle Abscesses (Pyomyositis Tropicans). British Journal of Surgery 50: 846-852, 1962-63.
2. Abram, J.H., Inflammation of the Muscles, with special references to two cases of infective myositis. Lancet ii: 1341-1342, 1904.
3. Adams, R.D., and Denny-Brown, D. Diseases of Muscle. New York, 1962. (2nd edition) Harper and Row, Inc. p 386.
4. Baker, G.P. Case records of the Massachusetts General Hospital. New England Journal of Medicine 272: 424-425, 1965.
5. Barret, A.M. and Gresham, G.A. Acute Streptococcal Myositis. Lancet 274 i: 347-351, 1958.
6. Blum, L. and Keefer, E.B.C. Clinical entity of cryptogenic mycotic aneurysm. J.A.M.A. 188: 505-508, 1964.
7. Burkitt, R.T. Tropical myositis. Journal of Tropical Medicine and Hygiene 50: 71-75, 1947.



8. Buxton, P.A. Researches in Polynesia and Melanesia, 1924-25. London School of Tropical Medicine and Hygiene, Memoir #2: 31-45, 1928.
9. Chesterman, C.C. Communication. Transactions of the Royal Society of Tropical Medicine and Hygiene 24: 359-360, 1930.
10. Clark, F.W. A case of acute suppurative myositis. British Medical Journal 2: 69-70, 1887.
11. Cook, J. Pyomyositis. East African Medical Journal 40: 574-579, 1963.
12. Cullen, T.S. and Broedel, M. Lesions of the rectus abdominis muscle simulating an acute intra-abdominal condition. Bulletin of the Johns Hopkins Hospital 61: 295-348, 1937.
13. Dennison, W.M. and Dick, A.L. Surgery in West Africa: experience in a military hospital. Journal of the Royal Army Medical Corps 82: 112-124, 1944.
14. Earle, K.V. Sulphanilamide derivatives in the treatment of tropical myositis. Trans. Roy. Soc. Trop. Med. Hyg. 33: 169-172, 1939.



15. Fleming, A. McK. Tropical myositis. Trans. Roy. Soc. Trop. Med. Hyg. 24: 127-128, 1930.
16. Foster, W.D. The bacteriology of tropical myositis in Uganda. Journal of Hygiene 63: 517-524, 1965.
17. Gage, H. Post-influenzal abscesses of the sheath of the rectus abdominis. Annals of Surgery 70: 188-191, 1919.
18. Gelfand, M. Tropical phlebitis and its relation to myositis tropica. Journal of Tropical Medicine and Hygiene 52: 248-252, 1949.
19. Grace, A.W. and Grace, F.B. Researches in British Guiana, 1926-28. London School of Tropical Medicine and Hygiene, Memoir #3: 8-11, 1931.
20. Gray, G.M. Tropical myositis. West African Medical Journal 3: 87, 1930.
21. Holm, G. Beiträge zur kenntnis der "myositis infectiosa". Acta Chirurgica Scandinavica 27: 415-448, 1924.
22. James, C.S. Tropical myositis. Trans. Roy. Soc. Trop. Med. Hyg. 25: 177-180, 1931.



23. Johnson, W.B. A note on tropical myositis. West African Medical Journal 3: 87, 1930.
24. Leedham-Green, J.C. and Evans, W. Myositis tropica. Trans. Roy. Soc. Trop. Med. Hyg. 36: 359-362, 1943.
25. McConnell, R.L. A case of myositis purulenta tropica. Journal of Tropical Medicine 26: 57-59, 1923.
26. Payne, J.F. A case of acute myositis of the thigh. Transactions of the Pathological Society of London 32: 273-275, 1881.
27. Robbins, S.L. A Textbook of Pathology. Philadelphia, 1962. W.B. Saunders Co. p 107.
28. Robertson, R.L. Tropical myositis in Adamawa Province, Nigeria. West African Medical Journal 3: 80-82, 1930.
29. Robin, G.C. Tropical myositis in Malaya. Journal of Tropical Medicine and Hygiene 64: 288-291, 1961.
30. Sayers, E.G. Tropical myositis and muscle abscesses. Trans. Roy. Soc. Trop. Med. Hyg. 23: 385-400, 1930.



31. Scott, H.H. Deep suppuration of the thigh associated with a peculiar bacillus. Journal of Tropical Medicine and Hygiene 15: 97-100, 1912.
32. Sworn, B.R. Acute psoas abscess. British Medical Journal 2: 6-7, 1933.
33. Traquair, R.N. Pyomyositis. Journal of Tropical Medicine and Hygiene 50: 81-89, 1947.
34. Walker, E.L. The etiological agent and the localizing factor of the abscesses in myositis purulenta tropica. Journal of Infectious Disease 21: 298-302, 1917.
35. Wise, K.S. and Minnett, E.P., Report of tropical disease research in the government bacteriological laboratory, British Guiana, for the six months October 1911-March 1912. Report of the Advisory Committee for the Tropical Disease Research Fund for the year 1912: 108-114, 1913; (abstracted in Tropical Disease Bulletin 2: 93, 1913).
36. Wiseman, R.H. Confusion between scurvy and tropical myositis with reference to an outbreak of scurvy among prisoners. East Africa Medical Journal 20: 263-277, 1943.



37. Young, W.A. and Clark, E.M. Report of a small epidemic of hypovitaminosis. Trans. Roy. Soc. Trop. Med. Hyg. 34: 249-260, 1940.

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